THE MIGRATION OF BUTTERFLIES IN INDIA.

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(*With one coloured plate and 4 diagrams*).

INTRODUCTORY.

The migrations of birds and mammals have been known for many centuries, and similar movements of fishes are now being studied with results of great practical importance. Among the insects great swarms of locusts have always attracted attention, but the fact that extensive movements take place in other groups is still but little known to the general public, and even in some cases to the naturalist himself.

It is now however a well established fact that many species of butterflies and moths make regular movements in the adult stage, over distances which frequently exceed a thousand miles. Thus in North America, the Monarch Butterfly (*Danaus plexippus*) flies in great numbers each Autumn from Southern Canada to Florida, the Gulf States or Mexico, and then returns to repopulate the northern area in the Spring.

In Western Europe and North Africa the Painted Lady (*Vanessa cardui*) flies regularly in large numbers from the borders of the North African desert, across the Mediterranean, northwards through Europe, and may in extreme cases reach Iceland and almost to the Arctic Circle in Russia.

That the phenomenon is not a rare and unusual occurrence may be seen from the fact that of the sixty-eight species of butterflies known to occur in the British Isles, fourteen are partially or completely dependent on immigration from the Continent for their continued existence in Britain.

The known movements of the migrant butterflies have been slowly established by the collection of individual records of directional flights, and also by discovery (often very difficult to verify) that certain insects are only to be found over large areas at one particular time of the year.

MIGRATIONS IN INDIA.

In India the latter form of evidence is not generally available, owing to insufficient study, but it has been used in support of the supposed migrations of the moth *Agrotis ypsilon* from the 'tal' lands of Mokamek in Bihar.

Directional flights of butterflies have however been known to occur here for many years.

The first record that I have been able to trace is in an English newspaper *The Liverpool Mercury and Lancashire General*

Advertiser of just a hundred years ago. In the issue for 21st December 1838 there is a paragraph which states 'Mr. Moore records a flight in India of butterflies which extended 500 miles, and Mr. Barrie describes one in Africa which occupied an area of 2,000 miles'. In a later issue of the same newspaper (4th January 1839) the Editor comments that stories about locusts can apparently be believed, but he considers stories of great flights of butterflies as merely 'flights of fancy'!

Several records and discussions of butterfly flights in Ceylon appeared about the middle of last century, but interest in India did not seem to be aroused till about the end of the century, when several short papers and notes appeared in the *Journal* of the Bombay Natural History Society and elsewhere.

Since then observers of strikingly large flights have occasionally sent in their records for publication, but no one has made any continuous study of the subject except Mr. J. Evershed, F.R.S. who was for many years Director of the Observatory at Kodaikanal, in the Pulni Hills, South India at an altitude of about 7,700 feet. Mr. Evershed observed directional movements of butterflies at Kodaikanal on numerous occasions between 1907 and 1914, and also in 1921. In 1926 he kindly placed the whole of his notes at my disposal and a full report on them has already been published (Williams 1927). Summaries of his observations will be given below.

Directional flights of butterflies are also known to occur in most of the countries bordering on India. In Ceylon they are particularly frequent and the available evidence was summarised by the present writer in 1927.

In Burma and Malaya movements seem to have been less frequently observed, but they are not uncommon in Siam and the East Indies, and probably only need a close watch to be found almost everywhere.

For the area to the North of India no information is forthcoming.

Information at present available in India.

In 1930 (Williams 1930) I made a general survey of the problem of migration of butterflies throughout the world, and included in it notes on the Indian butterflies that had been known to migrate. It appeared from the evidence then available that the species concerned in the migrations in the foothills of the Himalayas were very different from those of Central and South India. In this present review therefore the records along the mountains in the north will be kept distinct from those of the rest of India.

In order to summarise as briefly as possible the records that I have so far traced, they are condensed into three tables. Table I shows the records for North India and the Himalayas; Table II Evershed's records for Kodaikanal; and Table III shows the records for the rest of the country. Finally Table IV gives a list of all the species which have been recorded as migrating anywhere in India with the names of the observers of their movements.

All the flights in Tables I-III are shown in diagrammatic form in Fig. 1.

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INDIAN MIGRANT BUTTERFLIES.

A. *Colias fieldi*, Menetr. ♂
B. *Catopsilia crocale*, Cram. ♀
C. *Vanessa cardui*, Linn. ♂
D. *Catopsilia pyranthe*, Linn. ♂
E. *Lampides bœticus*, Linn. ♂
F. *Pieris brassicæ*, Linn. ♂
G. *Danaus hamata septentrionis*, Butl. ♀
H. *Danaus genutiæ*, Cram ♂
I. *Euplœa core*, Cram ♂

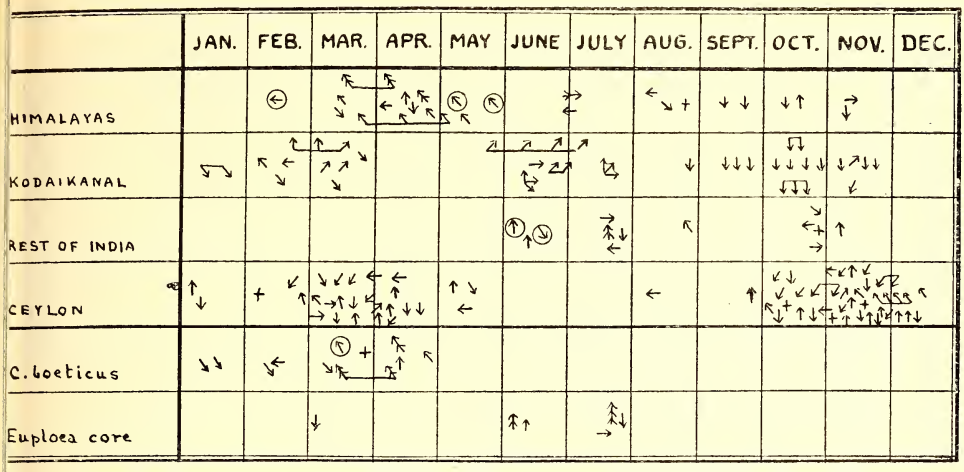

Fig. 1.—Diagram showing the date and direction of recorded flights in different parts of India and Ceylon, and also the recorded flights of *C. boeticus* and *E. core* in India.

An examination of Table I and the corresponding portion of Fig. 1 shows that the flights in the foothills of the Himalayas are chiefly in two seasons; the first in March, April and May; the second mid-August to early November; corresponding more or less to the Spring and Autumn. The flights in the Spring season are most frequently to the N.-W. and in the Autumn to the South, as shown in Fig. 2.

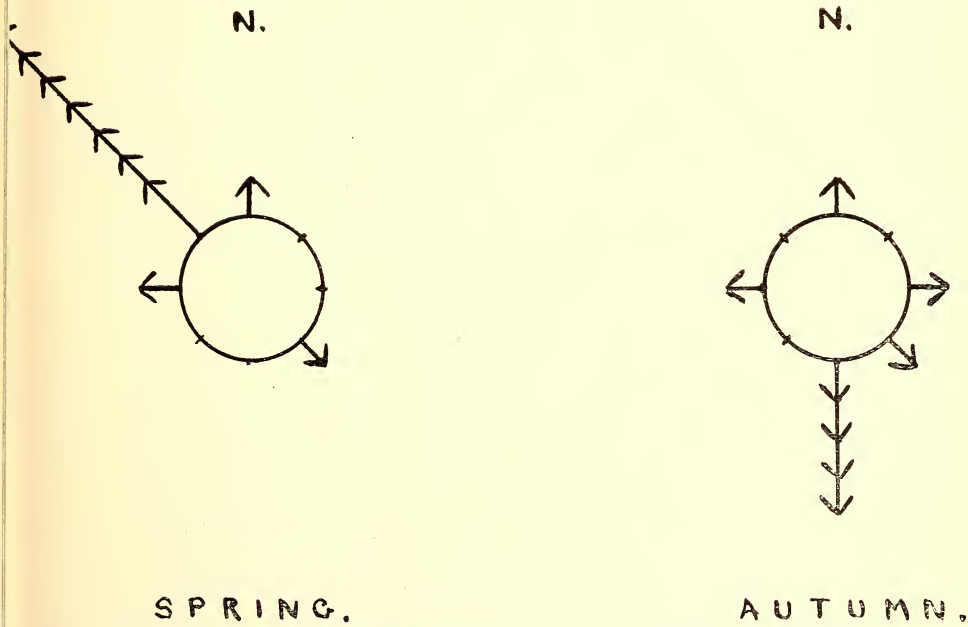

Fig. 2.—Diagram showing the directions of the recorded flights of butterflies in the Himalaya region of India separated into Spring and Autumn seasons.

TABLE I.—N. INDIA AND HIMALAYAS.

Date	Locality	Species concerned	Direction	Observer and Reference
April ...	Naini Tal, U.P. ...	*Lampides boeticus*	To North ...	Lang (de Niceville 1890).
Spring ...	Mussoorie ...	do.	...	Mackinnon (de Niceville 1890).
Annually End June to beg. July ...	Dehra Dun, U.P. ...	*Catopsilia crocale* and *C. pyranthe* ...	Most to West Sometimes to East	Ollenbach (Williams 1930b).
1900 Aug. 12 ...	Palampur, Kangra ...	*C. crocale* and a few *C. pyranthe* ...	To East ...	Dudgeon (1902).
1901 March, April, and Annual ...	Lucknow Dist., U.P....	*L. boeticus*	To North-West ...	de Rhé-Philipe (1902).
1901 April 7 ...	Palampur, Kangra ...	*A. mesentina* and a few *Danaus genutia*	To West ...	Dudgeon (1902).
1900 August ...	Shandur Pass, Chitral.	*Vanessa cardui*	To South-East ...	Evans (Williams 1935).
1908 Mid October.	Naini Tal, U.P. ...	*Precis iphita*	To South ...	Peile [See Appendix].
1909 April 16 ...	Mussoorie ...	*Colias fieldi edusina*	,, ...	,, ,,
1909 October ...	Valley of Doone ...	Unknown	To North ...	Crothers (Williams 1935).
1912 August 20 ...	Mussoorie ...	*Catopsilia*	...	Peile (Williams 1928).
1913 April 30 ...	,, ...	*L. boeticus*	To North-West ...	Peile [See Appendix].
1913 May ...	,, ...	*Spindasis nipalicus*	'Down the nullah.'	,, ,,
1915 November ...	Kampilong, Darjiling.	*Appias lalage*	To East ...	Roberts (Williams 1928).
1916 March ...	Khyber Pass ...	*Euchloe lucilla*	To South-East ...	Evans (Williams 1935).
1916 May ...	Mussoorie ...	*Papilio agestor*, *Delias sanaca*, *Neptis hylas*, *Parathyma opalina*, *Arhopalas* spp.	To North-West ...	Peile [See Appendix].
1916 End May ...	,, ...	*Delias sanaca* and others	'Down the nullah.'	,, ,,
1916 September ...	Mussoorie, U.P. ...	*D. genutia*, *Precis iphita*, *Neptis hylas*, *Lethe vaivarta*, *Papilio polytes*, *Terias hecta*, *T. libythea* *T. hecabe*, *Celastrina pusha* *Syntaruches plenius*, *Everes argiades*, *Vanessa canace* and others...	To South ...	,, ,,
1918 2nd half of September ..	Mussoorie ...	*Achlarus bifasciatus casyapa* ...	To South ...	Ollenbach (Williams 1930b).
1919 End March—May ...	Dharmsala, Kangra...	*Pieris brassicae*, with *Colias fieldi* and a few *D. chrysippus*, *V. cashmirensis* and *Polyommatus boeticus*	To North-West ...	Hingston 1928.
1920 ? Feb. ...	Rawalpindi ...	*L. boeticus*	To West ...	Evans 1927 and (Williams 1935).
1924 November ...	Dehra Dun, U.P. ...	*Kallima inachus huegelii*	To South ...	Ollenbach (Williams 1930b).
1928 March 17-25.	Naini Tal, U.P. ...	*L. boeticus*, and a few *Colias fieldi*...	To North-West ...	Broughton (Williams 1930b).
1928 Mid April ...	Dehra Dun, U.P. ...	*L. boeticus*, (annual event but very		

The species concerned in these flights are given in the following list. An I. after the name denotes that it has also been recorded as migrating in other parts of India, and a C. after the name denotes that it has also been recorded as migrating in Ceylon.

PAPILIONIDÆ.

Papilio agestor.
Papilio polytes. C.
Papilio machaon.

PIERIDÆ.

Euchloe lucilla.
Pieris brassicae.
Delias sanaca.
Glycestha aurota. I.C.
Appias lalage.
Catopsilia crocale. I.C.
Catopsilia pyranthe. I.C.
Terias libythea.
Terias laeta.
Terias hecabe. I.C.
Colias fieldi.

DANAIDÆ.

Danaus tytia.
Danaus genutia. I.C.
Danaus chrysippus.

NYMPHALIDÆ.

Lethe sidonis.
Parathyma opalina.
Neptis hylas.
Kallima inachus.
Precis iphita.
Vanessa cardui.
Vanessa canace.
Aglais cashmirensis.
Phalanta phalantha. I.C.

LYCAENIDÆ.

Syntarucbus telecanus.
Everes argiades.
Lycaenopsis puspa. C.
Lycaenopsis huegelii.
Cosmolyce boeticus. I.C.
Spindasis nipalicus.

HESPERIDÆ.

Lobocla bifasciatus.

It will be seen that of the thirty-three species recorded, only ten have been seen migrating further south in India or Ceylon.

The most regular migrant of all in this area is undoubtedly *L. boeticus*, the long-tailed Blue (Plate, Fig. E) which has been recorded as migrating by no fewer than nine different observers in India, and by Ormiston in Ceylon (Williams 1927, p. 24). The same species is also known as a migrant in Europe and North Africa and is found in many of the oceanic Islands of the Pacific. The records in the Himalayas are all to the North or N.-W. in February, March and April. At Kodaikanal, Evershed observed four flights in January, February and March, but all to the south or south-east. In Ceylon no exact dates are available.

Another most interesting migrant is *Pieris brassicae*, the Large Cabbage White Butterfly (Plate, Fig. F), which migrates not only in India, but also on a large scale in Europe (see Williams 1930, pp. 112-21). Lefroy (1909) says that in India this butterfly migrates from the hills in the cold weather and early hot weather. It spends this period in the submontane districts of the Himalayas, breeding on cultivated *Crucifers*, and returns to the hills for the summer. Fletcher (1925) says that it first appears at Pusa about the first week in February, and two or three generations are passed through rapidly before the end of April. At the beginning of May all disappear, and do not reappear till the following February. The only observed case of actual migration is that of Hingston (1928) referred to in Table I.

SPECIES	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
PAPILIONIDÆ												
Papilio demoleus												
" *hector*												
PIERIDÆ												
Catopsilia pyranthe												
" *crocale*												
" *catilla*												
" *(florella?)*												
" *spp.*												
Appias (usually albina)												
Hebomoia (glaucippe)												
DANAIDÆ												
Danais aglioe												
" *plexippus*												
" *limniacæ*												
" *septentrionalis*												
Euploea core												
NYMPHALIDÆ												
Hypolimnas bolina												
" *misippus*												
Junonia hierta												
" *orythya*												
" *lemonias*												
" *sp*												
Atella phalanta												
" *ariadne*												
" *spp.*												
LYCÆNIDÆ												
Polyommatus boeticus												
HESPERIDÆ												
Parnasa mathias												
DRAGON FLIES												

Fig. 3.—Diagram showing the directions and months of all flights of butterflies recorded at Kodaikanal, S. India by Mr. J. Evershed, F.R.S.

(Reproduced from the *Trans. Ent. Soc. London* 1927, p. 8 by kind permission of the Society.)

Vanessa cardui, the Painted Lady (Plate, Fig. C), is one of the most widespread of all butterflies and is a regular migrant in both Europe and North America. It occurs throughout India and Ceylon and has been found far out at sea in the Indian Ocean. In Ceylon, Ormiston (1924) says that on occasions it appears suddenly in great numbers but he has no other evidence of migration. Aitken (1897) states that 'At different times of the year, but most often I think in June, large numbers of this species appear about the rocks on the seashore and in other barren situations and I am inclined to think that they are new arrivals from some other country. . . . A certain number remain permanently with us and breed on a common species of *Blumea*.' The only record of an actual flight is the one recorded by Evans in the Shandur Pass, Chitral. (See Table I.)

At Kodaikanal (Table II and Fig. 3) Mr. Evershed observed numerous migrations between 1907 and 1914, and one flight in 1921. About twenty-three species were noted, and the flight seasons fell definitely into three periods. The main flights were towards the south in October and November and included nearly all the observed species (but not *P. boeticus*). In February and March a return flight to the north occurred, but consisted only of *Catopsilia* spp. and *Appias* spp. Then after a blank period in April there was renewed activity in May and June in the same two genera, with some *Papilio polytes*, but the direction of flight was less definite. Of about 22 species observed by Evershed only 5 have been recorded as migrating in the Himalayan area; but all but two species (*Precis orithya* and *Pelopidas mathias*) are known migrants in Ceylon.

TABLE II

Obeservations made by J. Evershed at Kodaikanal, S. India.

Date	Species	Direction
1907		
February—March ...	*Catopsilia pyranthe* ...	North.
1908		
May 16 to begin. July.	*Catopsilia crocale*	North and N. by E.
October 7–21 ...	Dragonflies, *Papilio demoleus* (enormous numbers), *P. bolina*, *P. hector*, *Catopsilia crocale*, *C.? catilla*, *D. plexippus*, *limniace* and *septentrionis*, *Junonia hierta*, *J orithya*, *J. lemonias*, *Atella phalantha*	South.
1909		
March 28 ...	*Euploea core*, *C. crocale*, *C. pyranthe*	To South-East.
June 13–15 ...	*C. crocale*, *C.pyranthe*, *P. demoleus* and others	East, East by South and North-East.

Observations made by J. Evershed at Kodaikanal, S. India—(*Contd.*)

Date	Species	Direction
October 3–25 ...	*P. demoleus, E. ariadne, A. phalantha, J. orithya, J. hierta, J. lemonias, H. bolina, C. pyranthe*, a few *P. hector* and *Parnara mathias* (great many)	South, South by W., S.S.-W and S.W.
1910 ...	No records	
1911		
Jan. 4–28 and Feb. 19...	*Polyommatus boeticus* ...	South-East.
January 28–30 ...	*Appias albina*	South-East by South.
February 12 and 19 ...	Catopsilias	West and N.-West.
March 12 ...	*Appias* sp.	North-East.
March 19 ...	*P. boeticus* (many) ...	To South-East.
	Appias, males (several) ...	North-East.
	Catopsilias (a few) ...	North.
1912		
Mar. 23, 24, 25, and 28.	*Catopsilia pyranthe* only, in numbers	North by East.
May 19 (about) ...	*Catopsilia catilla* ... ... *Appias* and a few Catopsilias	E., E.S.E. and S.-E. N. and N. by E.
May 20–29 ...	*Catopsilia catilla* (pale form); on 28th all *crocale* ...	Mostly E. to S.-E., also some North to North-East.
July 31 ...	Large Catopsilias	Various, but mostly North to East.
September 11 ...	*C. pyranthe* (several), *P. hector* (only one)	South.
September 21 ...	*D. limniace* (5 or 6) ...	South or South by E.
September 15–29 ...	*H. bolina* (several each day) ...	Towards S.-W. to S.-East.
October 6 ...	*H. bolina* (large numbers of both sexes)	South and S.S-W.
October 9 ...	*C. pyranthe* (large numbers) ...	South and S.-W.
October 13 ...	Do do. ...	More or less S.
October 16 ...	*C. pyranthe* (snow-storm)	
,, ...	*P. demoleus* (large numbers), *A. phalantha*, *H. missipus* (considerable number of females, a few males), *H. bolina*, *D. plexippus* (1), *D. limniace* (1), *J. hierta* (a few), *J. lemonias* (1), *C. florella*? (a few)	S. (more or less).
October 30 ...	*P. demoleus* (large numbers), *C. pyranthe* (snow-storm), *H. bolina* (a few)	S. (more or less).
October 31 ...	*C. pyranthe, P. demoleus, Atella* (great many of all) ...	S. (more or less).
November 3–4 ...	*C. pyranthe* (small number) ...	North-East.
November 5–6 ...	*C. catilla* (considerable numbers)	S.-W. and W.S.-W.
	P. demoleus (a few), *H. bolina* (a few), *Junonia* sp. (several)	S.-W. (more or less).
November 10 ...	Hebomoias (many), Catopsilias (*catilla* chiefly) ...	South.
November 14–22 ...	*P. demoleus* and Catopsilias ...	South.

Observations made by J. Evershed at Kodaikanal, S. India—(*Contd.*)

Date	Species	Direction
1913		
March 2–9 ...	Catopsilias and *Appias* (a few only)	North.
May 18–31 and June 1.	*Calopsilia crocale, calilla* or *florella* (not *pyranthe*) ...	N.-E. and E.N.-E.
1914		
November 11 ...	*Calopsilia calilla* (considerable numbers), also *E. ariadne*, Junonias, *Atella phalantha* ...	West and W. by S.
1915–20	No records	
1921		
August 21 ...	*C. pyranthe* (many), also *C. crocale, P. demoleus* (many), *A. phalantha* (many), *D. aglea* (a few), *J. hierta* (a few)	South.

The October-November season at Kodaikanal corresponds to the change of the S.-W. to the N.-E. monsoon and is the period of maximum rainfall.

In the remainder of India (Table III, p. 449) there are only nineteen recorded flights, of which at least 12 refer to butterflies of the family *Danaidae*, and chiefly to *Euploea core*. The flights of this species seem to occur fairly regularly in the Bombay area in June and July and are chiefly towards the north. It has never been recorded in the Himalayan area, and only once at Kodaikanal, but it regularly joins in the flights in Ceylon in November and December, and again to a smaller extent in March and April.

All the localities at which butterfly migrations have been recorded in India are shown in Fig. 4 together with the direction of flight. They are well scattered over the country, but there are still very large areas from which no information is available.

A general survey of the evidence available for India thus shows that we have about eighty records of unidirectional flights over the whole country, of which about half are due to Mr. Evershed at Kodaikanal.

These records include 52 species (see table IV, p. 450) of which 27 are also known to migrate in Ceylon.

When it is realised that for the Cabbage White Butterfly, *Pieris brassicae*, we have a hundred records of flights for England alone, and another hundred for the Continent of Europe, and that for the Painted Lady (*Vanessa cardui*) we have about 400 records in different parts of its range, it will be seen that the problem in India is in a very early stage of investigation.

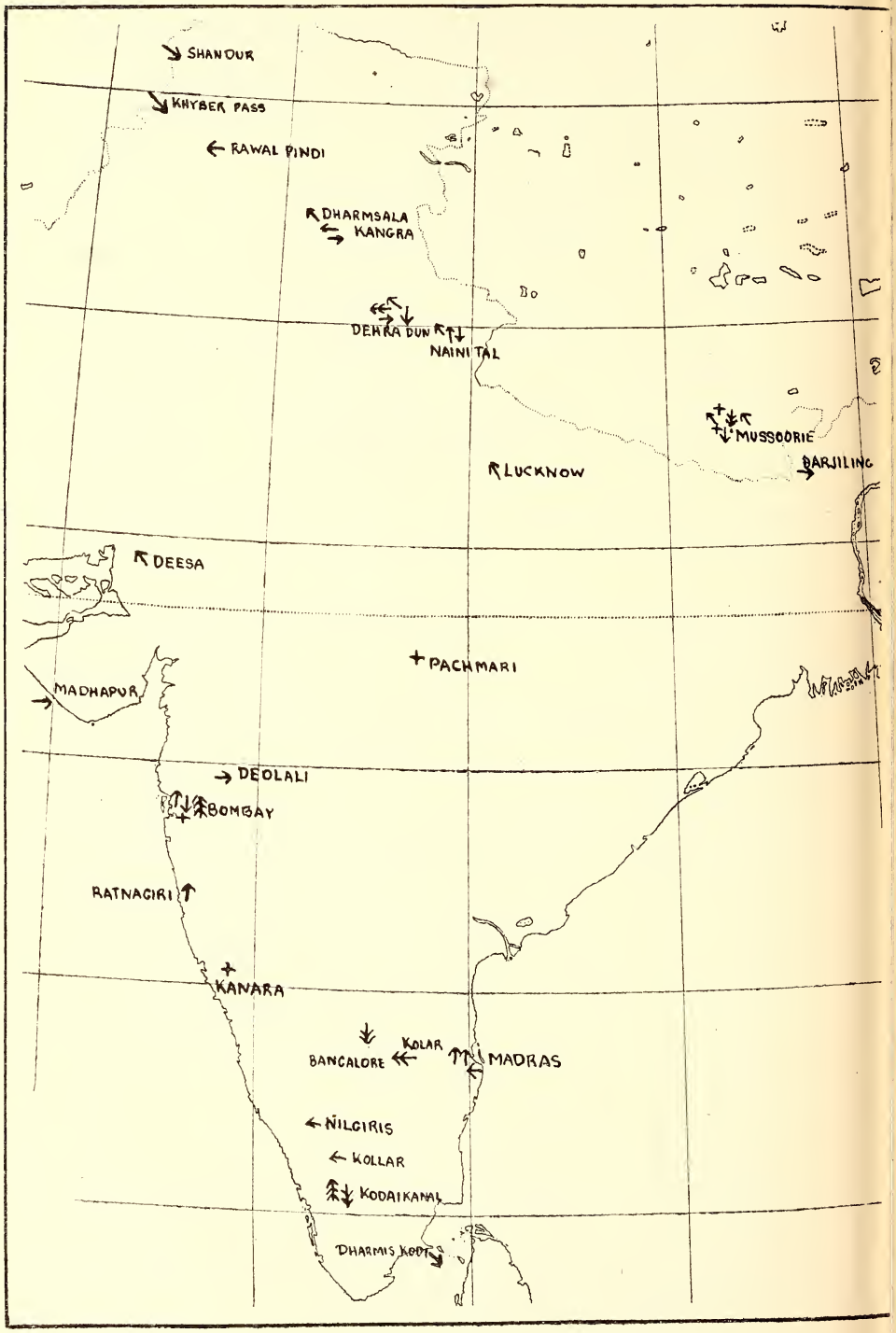

Fig. 4.—Map of India showing localities and directions of the recorded flights of butterflies.

TABLE III.—REST OF INDIA.

Date	Locality	Species	Direction	Observer and Reference
..	Siddapur, N. Kanara.	Danains	...	Prall 1898.
Several years ...	Bangalore ...	Danains, Euplœas, Catopsilias ...	To South ...	Kuhni Kannan (Williams 1929b).
,, ...	Kolar Gold Fields, Mysore ...	Danains	To West ...	Rowntree [See Appendix].
Many years, about begining June ...	Bombay ...	*Euploea core*	To North ...	Aitken 1898.
1897 ...	Ratnagiri, Bombay ...	do.	do. ...	Aitken 1897.
1897 October 21 ...	Mody Bunder, Bombay	do.	...	Prall 1898.
1898 July 26–27 ...	Bombay ..	do.	To S (only time seen in this direction) ...	Aitken 1898.
1900 July 22 ...	,, ...	do.	To North ...	Aitken 1900.
1901 Aug. 25–27 ...	Deesa, Bombay ...	*Catopsilia pyranthe*	To North-West ..	Nurse 1902.
1908 October 18 ...	Nilgiris ...	Euplœas	To West ...	Andrewes 1910.
1909 July 26 ...	Madras ...	*Danaus septentrionis*	do. ...	Punnett (Williams 1935).
1912 November 3...	,, ...	Mostly Catopsilias	To North ...	Patton (Williams 1927b).
1918 ...	,, ...	Catopsilias and Danains	do. ..	Hopkins (Williams 1928).
1920 about June ...	Kellar, Nilgiris ...	Danains	To South-East ...	Parlett [See Appendix].
1921 October 28 ...	At sea five miles off Madhapur ...	*A. mesentina, Teria hecabe* ...		
		P. demoleus, E. core, D. genutia, ...		
		Precis hierta, H misippus, ...		
		P. aristolochiæ, Teracolus, amatus ...	To East ...	Wall 1921.
1922 July ...	Deolali, Bombay ...	*E. core*	do. ...	Tulloch (Williams 1930b).
1922 September ...	Pachmari, Cent. Prov.	*C. crocale, C. pyranthe, T. hecabe,* etc.	...	
1932 October 30 ...	Dhamiskodi ...	Dark butterflies	To South-East ...	Hinchey (Williams 1935).
1937 June 13 ...	Bombay ...	*Euploea core*	To North ...	Ghose [See Appendix].

TABLE IV.—INDIAN BUTTERFLIES RECORDED AS MIGRANTS.

PAPILIONIDÆ.

**Papilio hector* L. :—Evershed.
**Papilio aristolochiæ* Fabr. :—Wall.
Papilio agestor Gray :—Peile.
**Papilio polytes* Linn. :—Peile.
**Papilio demoleus* Linn. :—Wall, Evershed.
Papilio machaon Linn. :—Peile.

PIERIDÆ.

Euchloe lucilla Butler :—Evans.
Pieris brassicæ Linn. :—Hingston, Lefroy, Fletcher (Plate, fig. F).
Delias sanaca Moore :—Peile.
**Glycestha aurota* Fab. (*mesentina* Cr.) :—Dudgeon, Wall.
Appias lalage Dbdy. :—Roberts.
**Appias albina* Bdv. :—Evershed.
**Catopsilia crocale* Cr. :—Dudgeon, Ollenbach, Evershed (Plate, fig. B).
**Catopsilia pomona* f. *catilla* Cr. :—Evershed.
**Catopsilia pyranthe* Linn. :—Dudgeon, Ollenbach, Nurse, Evershed. (Plate, fig. D).
**Catopsilia florella* Fabr. :—Evershed.
Terias libythea Fab. :—Peile.
Terias læta Bdv. :—Peile.
**Terias hecabe* Linn. :—Peile, Wall.
Colias fieldi Men. :—Hingston, Broughton, Peile (Plate, fig. A).
Colotis amata Fabr. :—Wall.
Hebomoia glaucippe Linn. :—Evershed.

DANAIDÆ.

**Danaus aglea* Cram. :—Evershed.
Danaus tytia Gray. :—Peile.
**Danaus limniace* Cram. :—Evershed.
**Danaus hamata septentrionis* But. :—Punnett, Evershed (Plate, fig. G).
Danaus genutia Cram. :—Dudgeon, Peile, Wall, Evershed. (Plate, fig. H).
Danaus chrysippus Linn. :—Hingston.
**Euploea core* Cram. :—Aitken, Prall, Wall, Tulloch, Ghose, Evershed. (Plate, fig. I).

NYMPHALIDÆ.

SATYRINÆ.

Lethe sidonis vaivarta Doherty :—Peile.

NYMPHALINÆ.

Parathyma opalina Koll. :—Peile.
Neptis hylas Linn. :—Peile.
**Hypolimnas misippus* Linn. :—Wall. Evershed.
**Hypolimnas bolina* Linn. :—Evershed.
Kallima inachus Bdv. :—Ollenbach.
**Precis hierta* Fabr. :—Wall, Evershed.
Precis orithya Linn. :—Evershed.
**Precis lemonias* Linn. :—Evershed.
**Precis iphita* Cram. :—Peile.
**Vanessa cardui* Linn. :—Evans. (Plate, fig. C).
Vanessa canace Johann. :—Peile.
Aglais cashmirensis Kollar. :—Hingston.
**Phalanta phalantha* Drury. :—Peile, Evershed.
**Ergolis ariadne* Moore. :—Evershed.

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* Also recorded as migrating in Ceylon.

LYCAENIDÆ.

Syntaruchus telecanus plinius Fabr. :—Peile.
Everes argiades Ever. :—Peile.
Lycænopsis huegelii Moore. :—Peile.
**Lycænopsis puspa* Hors. :—Peile.
**Cosmolyce bœticus* Linn. :—Lang, McKinnon, Hingston, Peile, Evans, de Rhe-Philipe, Broughton, Ollenbach, Evershed. (Plate, fig. E).
Spindasis nipalicus Moore. :—Peile.

HESPERIDÆ.

Lobocla bifasciatus casyapa Moore. :—Ollenbach.
Pelopidas mathias Fabr. :—Evershed.

OBSERVATIONS REQUIRED.

What is needed at the moment is a very great increase in the number of observers who will watch out carefully for any directional flights of butterflies, whether in large or small numbers; and who will send in their observations and specimens to the writer of this article or to the Curator of the Bombay Natural History Society.

The information required is first of all the locality, date and direction of flight, and secondly a number of specimens of the insects concerned, taken actually from the flight. Such specimens add very greatly to the value of the record, as from them identifications of species and variety can be obtained and dissections made to see the state of development of the eggs or ovaries. One or two specimens are much better than none; and, if opportunity occurs to catch them, up to fifty is not too many. The condition of the specimens is not of major importance, and for our immediate purpose a single broken specimen, or even a wing, enclosed in a letter is better than a perfect one which has escaped.

The best way to kill such specimens is to give the insect a sharp pinch at that part of the body where the wings and legs join it (technically the *thorax*). The wings can then be folded back and the butterfly placed in a small paper envelope, or between two sheets of paper in a flat cigarette tin.

If it is not possible to obtain specimens,—if for example the flight is seen from a railway train—, then as full as possible a description of the butterfly should be sent, giving approximate size and colour, whether with or without tails on the wings, etc. Records without specimens are always of interest, as are records of flights seen in the past if locality or date can be fairly well recollected.

Over and above the records of place, direction and date, the observer may send in almost any other details that occur to him. It is not desirable to have information too stereotyped and confined to certain channels, but it is always interesting to know such facts as the direction of the wind; the height of the insects above the ground; the approximate speed of flight; the time of the day; the weather conditions preceding and during the flight; how long the flight lasts and how many insects are estimated to be passing (e.g. dozens, hundreds, thousands, millions). Special watch should

* Also recorded as migrating in Ceylon.

also be made to see if more than one species is present and, if this is so, specimens of all species should be captured, if possible, with an estimate of their relative abundance.

Flights occur also in other groups of insects as well as butterflies. Fraser in 1916 described a large flight of Hawk moths (*Sphingidae*); and the serious pest *Agotis ypsilon* has already been mentioned as a migrant. The latter species is more fully discussed in my previous review (Williams 1930 b).

Dragonflies are also known to migrate in large numbers in many parts of the world but I have no record at present of any migration in India except the record by Evershed in October 1908 (Table II).

Since the above was written I have found another old record of butterfly migration in India. E. L. Arnold (1893) describes a flight of butterflies passing 'on a soft N.-E. breeze' in the Anamalai Hills, south of Palgat, Madras. The flight was apparently about mid-November but the year is not stated. The butterflies concerned were said to include *Papilio erithonius, Papilio pammon* (a male from *Papilio polytes*) and many Pieridae.

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APPENDIX

SOME UNPUBLISHED RECORDS OF BUTTERFLY MIGRATION IN INDIA.

(1) Danain butterflies in East Mysore.

Dr. W. B. Rowntree writes to me that large migrations of butterflies occur regularly in the district of Champion Reef, Kolar Gold Fields, East Mysore, all flying to the West. Writing on the 9th September 1936 he says that the flights are expected 'in about two months time'. He also adds that he is told that they cross the Western Ghats and may be seen in clouds flying out to sea.

The species were said to resemble illustrations of *Danaus septentrionis* and *D. genutia*, but no specimens were sent from an actual flight.

(2) Danain butterflies at Kollar, South India.

Mr. L. M. Parlett informs me that in 1920 about June he saw a large flight of Danain butterflies at Kollar in the Nilgiri Hills, South India, flying to the south-east. The flight appeared to consist almost entirely of *Euploea core* and *Euploea coreta,* and was so thick that the sky looked as if full of drifting brown leaves.

Kollar is said to be about 1,200 feet altitude at the foot of the Nilgiri Hills and about 4 miles from Mettupalayam.

(3) Euploea asela at Bombay.

Miss A. Ghose informs me that on 13th June 1937 a great swarm of butterflies passed over 'Black Bay' Reclamation, Bombay, flying towards the north. The flight lasted from 10 a.m. to noon and the number of insects was estimated at 30,000. Their speed was about 4 miles per hour and they flew at a height of from 4-60 feet above the ground. The wind was from the S.W. (Monsoon) and the sky fairly clear with bright sunshine.

Miss Ghose sent me two specimens, both of which were *Euploea asela.*

(4) Various butterflies at Mussoorie in September 1916.

Lt.-Col. H. D. Peile kindly sends me the following information.

On the 20th September 1916 at Mussoorie—United Provinces, India, on the southern slopes of the Himalayas at a height of

about 7,000 feet. Misty, with sunny intervals during which the following species were seen migrating from north to south against the wind.

DANAIDÆ.

Danaus genutia, common.

NYMPHALINÆ.

Precis iphita, very common.

Neptis hylas astola, wet season form. Eight taken evidently recently emerged, all the usual rather small size.

SATYRINÆ.

Lethe vaivarta, several.

**Callerebia scanda,* female captured, other worn ones seen.

**Callerebia hyagriva,* very worn female.

PAPILIONIDÆ.

Papilio polytes, seen.

PIERIDÆ.

Terias laeta, several.

Terias libythea, several.

Terias hecabe,

LYCAENIDÆ.

Celeastrina puspa, two females taken.

Syntarucus plinius, female.

Everes 'argiades' females. (May have included *E. dipora* and *E. diporides*).

On 21st September at same spot. Sunny with occasionally mist. Migration as yesterday including the following.

DANAIDÆ.

Danaus tytia, one seen near thistles.

Danaus genutia, two.

NYMPHALIDÆ.

Argynnis hyperbuis, female.

Neptis astola, nine of wet season form.

Precis iphita, very common.

SATYRINÆ.

Lethe vaivarta, three.

**Callerebia scanda,* two.

PIERIDÆ.

Terias hecabe, several.

Terias libythea, three.

Terias laeta, thirteen.

PAPILIONIDÆ.

Papilio polytes, ♀ form *cyrus* 1. ♀ form *polytes* 1.
Papilio machaon, several.

LYCAENIDÆ.

Celestrina puspa, two females.

Heavy rain followed on 24th, 25th and 26th September.

On October the 6th and 7th, 1916, at Fox's Hill, about 3 miles west of the previous locality, the stream of migration from north to south was continuing and included the following species.

DANAIDÆ.

Danaus tytia, one seen.
Danaus genutia, taken.

NYMPHALINÆ.

Phalanta phalantha, two.
Neptis astola, wet season form very common, several passing every few seconds.
Kallima inachus, one of the dry season form.
Vanessa canace, very common.

SATYRINÆ.

**Aulocera saraswata*,

LIBYTHEINÆ.

Libythea myrrha,

PIERIDÆ.

Terias libythea, both wet and dry season form.
Terias laeta, abundant.
Terias hecabe, common, many small.

On October 9th the migration continued as before including *Neptis hylas astola* and *Terias* spp.

With regard to the species marked with an asterisk, Lt.-Col. Peile states that these Satyrids have probably merely got mingled locally with the crowd of migrants.

(5) PRECIS IPHITA NAINI TAL, U.P. IN 1908.

Lt.-Col. H. D. Peile informs me that at Naini Tal, in mid-October 1908 *Precis iphita* was very common migrating from north to south over the crest of the mountain at about 8,000 feet.

(6) POLYOMMATUS BOETICUS AT MUSSOORIE IN APRIL 1913.

Lt.-Col. H. D. Peile informs me that large numbers of *P. boeticus* were passing from south-east to north-west at Mussoorie, on 30th April 1913 on the ridge about 5,500 to 6,000 feet above sea level.